



U. S. Department of Justice

Fire Research Laboratory
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Test record

ASCLD/LAB-*International* Testing Accreditation
Certificate ALI-217-T

Title	Burning Wall Panels		
Test Type	Calorimetry		
Lab Number	ATFFRL050002		
Test dates	7/28/05	No. Tests	3

Thermocouples

Thermocouples are temperature measurement sensors that consist of two dissimilar metals joined at one end (a junction) that produces a small thermo-electrical voltage when the wire is heated. The change in voltage is interpreted as a change in temperature [1]. There are many configurations of thermocouples which affect the temperature range, ruggedness, and response time. The information required to identify these factors for the thermocouples that were used during the experiment(s) conducted for this test series is provided in the "Thermocouple Measurement Description" table. Thermocouples used during this test series were used in accordance with the method defined in FRL laboratory instruction "LI001 Thermocouple" [2].

The following table provides a description of the instrumentation used to collect the temperature measurements during the experiments. The "Description" column describes the location of the temperature measurement. The "Z" location is the height of the thermocouple above the floor. The "Thermocouple Type" describes the characteristics of the thermocouple used.

Table 1. Thermocouple Measurement Description

Description	Z (m)	Thermocouple type
0.9 meter	0.9	Type K, Glass Ins., 24 ga wire
1.5 meter	1.5	Type K, Glass Ins., 24 ga wire
2.1 meter	2.1	Type K, Glass Ins., 24 ga wire
0.5 meter	0.5	Type K, Glass Ins., 24 ga wire

Weighing Devices

Weighing devices are instruments primarily used to measure the instantaneous mass of an object or to observe changes in the mass over a period of time. Weighing devices generally consist of the load cell(s), a weighing platform, and an indicator unit.

Weighing devices can be classified as scales or balances. Scales measure the physical change in the shape and/or the position of the scale as a result of a weight being applied to the scale. Balances use a counteractive force, typically an electromagnetic force, to maintain the original shape and/or position of the balance when a load is applied to the balance.

When a load is applied to the weighing platform, the load cells generate an electrical signal which is processed by the indicator and transferred to the indicator's digital display and/or other interfaces that are connected peripheral devices such as computers or data acquisition systems. Weighing device components vary depending on the model design and application. The weighing devices used during this test series were used in accordance with the method defined in FRL laboratory instruction "LI019 - Weighing Devices" [3].

The following table provides a description of the weighing device(s) used during the experiment.

Table 2. Weighing Device Descriptions

Manufacturer	Model Number	Range (kg)	Bar Code
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Fire Products Collector

A Fire Products Collector (FPC) measures several characteristics of a fire based upon the measured properties of the fire plume. A FPC consists of a collection hood connected to an exhaust duct placed over a fire as shown in Figure 1. The primary fire characteristics calculated from a FPC include heat release rate (HRR), convective heat release rate (CHRR), gas species production, and smoke production. HRR measurements are based on the principle of oxygen consumption calorimetry. CHRR is calculated as the enthalpy rise of gases flowing through the FPC. Gas species production is calculated based on the measured gas concentrations flowing through the FPC. Smoke production is quantified based on optical smoke measurements, which measure the attenuation of light as it passes through the smoke and fire gases in the FPC.

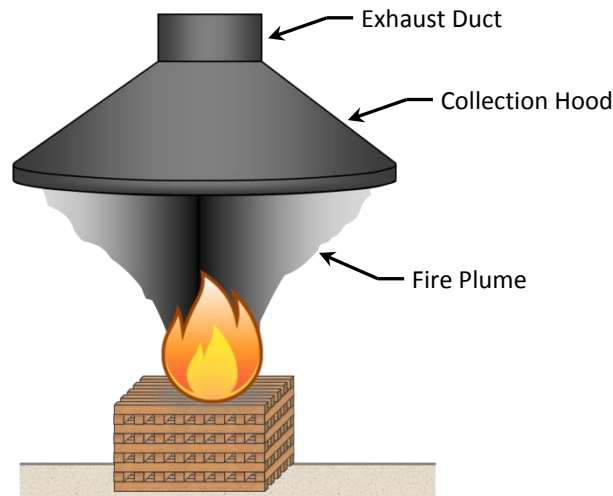


Figure 1. Schematic of a Fire Products Collector

The "Fire Products Collector Description" table identifies which FPC was used in the experiment(s) and summarizes the configuration. Fire Products Collectors were used in

accordance with the method defined in FRL Laboratory Instruction “LI011 Fire Products Collectors” [4].

The following table provides a description of the FPC used in the experiment(s). The table includes a description of the FPC, as well as the Calibration factor (C Factor) and E values, which are used to calculate the HRR during an experiment. The C Factor is based on data from a fire with a known HRR. E is the net heat released per unit of oxygen consumed, a property of the fuel being burned.

Table 3. Fire Products Collector Description

Description	C Factor	E (kJ/kg)
1 MW Square	1.02	13.1

Experiment Photographs

Digital Cameras are used within the FRL to record digital still photographs during experiments. Digital Cameras used during this test series were used in accordance with the method defined in FRL Laboratory Instruction “LI003 Digital Cameras” [5].

Results for Test 1 (ID 1323)

The following table provides a summary of the temperature results. The “Initial” column provides the measured temperature at the beginning of the test. The maximum temperature recorded during the test is provided in the “Max” column. The remaining columns provide the calculated maximum average temperatures.

Table 4. Temperature Value Result Summary

Description	Initial (C)	Max (C)	30 second maximum average (C)	60 second maximum average (C)	300 second maximum average (C)	600 second maximum average (C)
0.9 meter	27	83	80	75	50	25
1.5 meter	26	49	48	48	38	19
2.1 meter	26	61	60	60	47	24

The following chart(s) present a time-dependent representation of the instantaneous temperatures measured during the experiment.

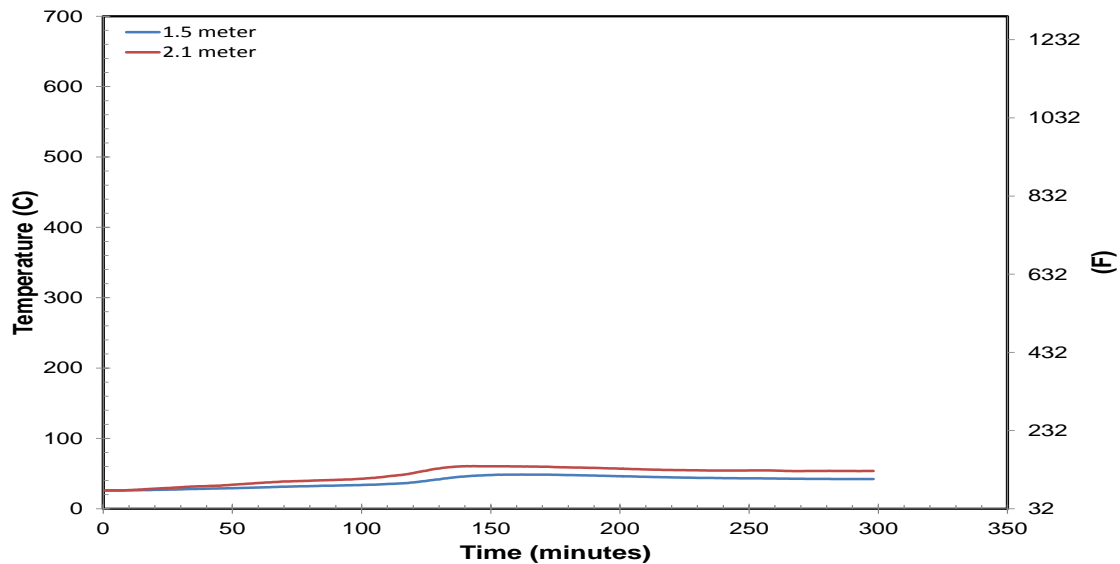


Figure 2. Temperature

The following table provides a summary of the weighing device results.

Table 5. Weighing Device Summary

Description
4 x 8 ft platform

The following chart shows the mass data measured during the experiment.

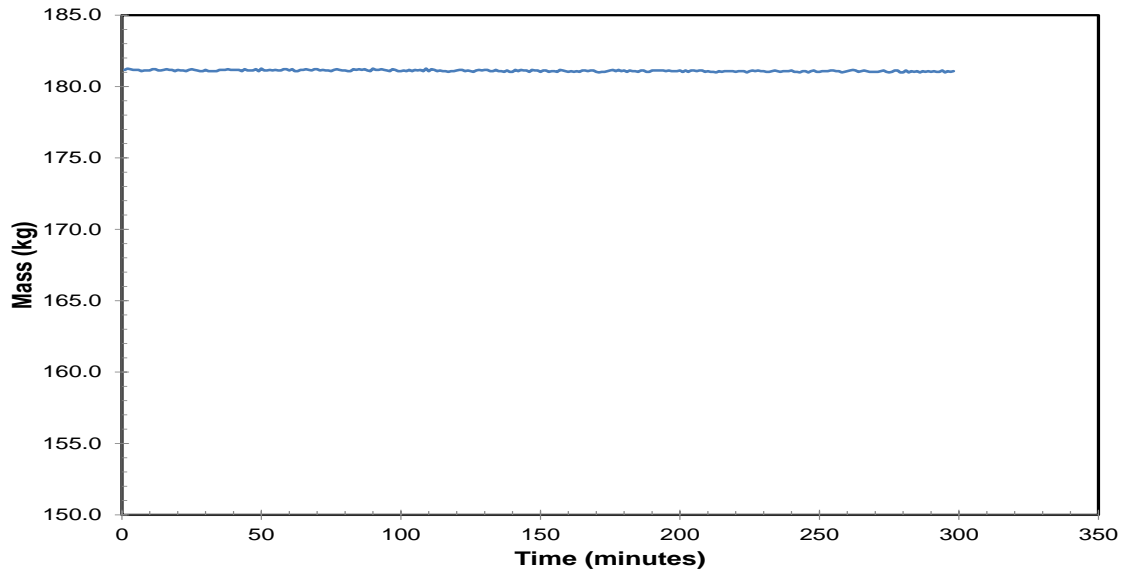


Figure 3. Mass Data

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.

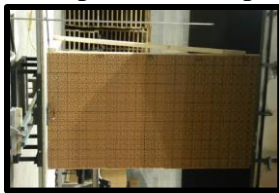


Figure 4. Pre test 15 seconds, 1323_18237

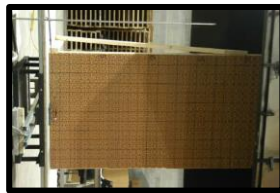


Figure 5. 4 seconds, 1323_18240

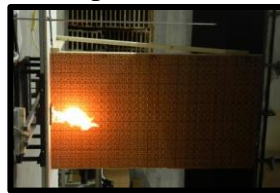


Figure 6. 27 seconds, 1323_18244



Figure 7. 50 seconds, 1323_18248

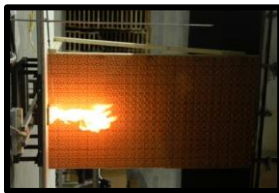


Figure 8. 71 seconds, 1323_18252

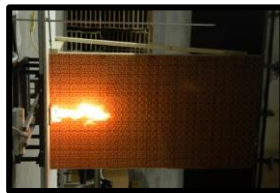


Figure 9. 95 seconds, 1323_18256



Figure 10. 117 seconds, 1323_18260



Figure 11. 138 seconds, 1323_18264



Figure 12. 162 seconds, 1323_18268



Figure 13. 185 seconds, 1323_18272



Figure 14. 209 seconds, 1323_18276



Figure 15. 232 seconds, 1323_18280

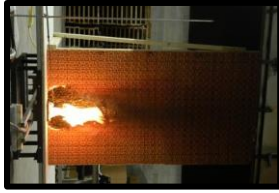


Figure 16. 255
seconds,
1323_18284



Figure 17. 278
seconds,
1323_18288



Figure 18. 300
seconds,
1323_18292

Results for Test 2 (ID 1330)

The following table provides a summary of the temperature results. The “Initial” column provides the measured temperature at the beginning of the test. The maximum temperature recorded during the test is provided in the “Max” column. The remaining columns provide the calculated maximum average temperatures.

Table 6. Temperature Value Result Summary

Description	Initial (C)	Max (C)	30 second maximum average (C)	60 second maximum average (C)	300 second maximum average (C)	600 second maximum average (C)
0.9 meter	27	399	354	338	290	244
1.5 meter	27	181	180	177	158	147
2.1 meter	26	83	83	83	78	70

The following chart(s) present a time-dependent representation of the instantaneous temperatures measured during the experiment.

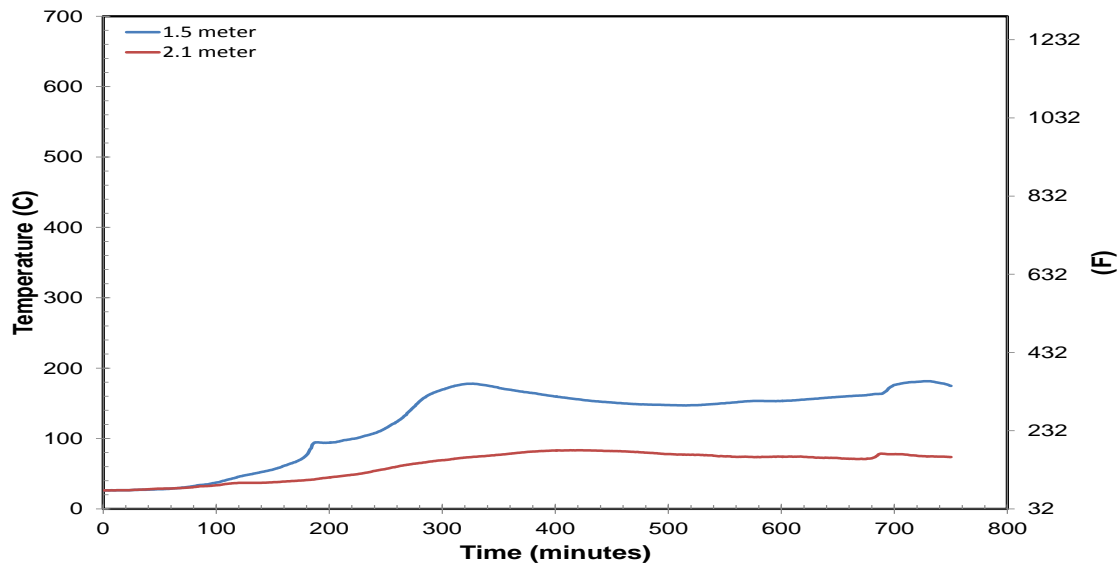


Figure 19. Temperature

The following chart shows the mass data measured during the experiment.

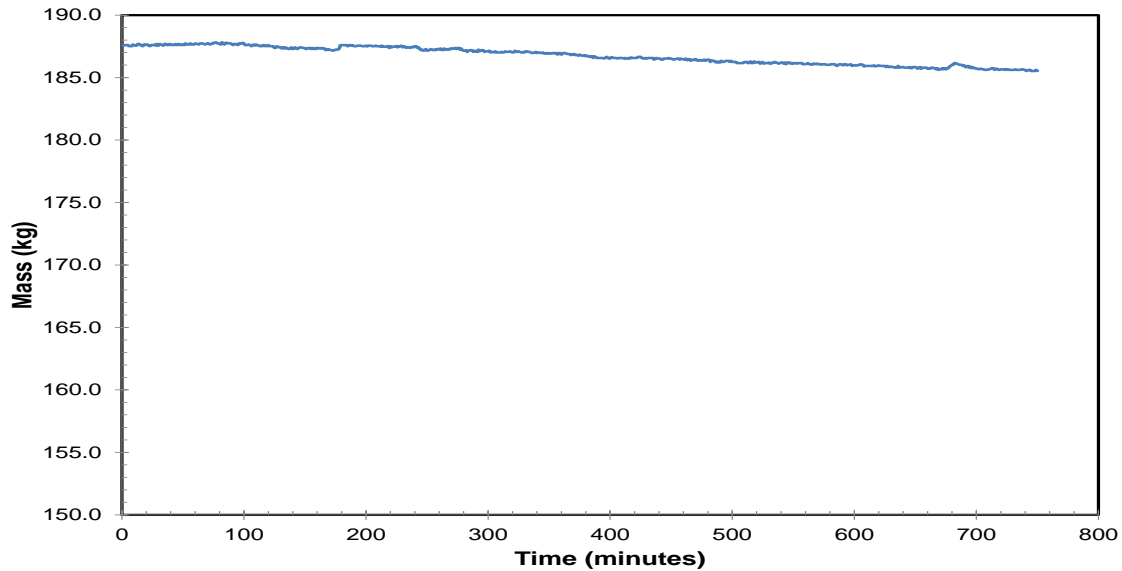


Figure 20. Mass Data

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.



Figure 21. Pre test
17 seconds,
1330_18311



Figure 22. Pre test
11 seconds,
1330_18312



Figure 23. 10
seconds,
1330_18314



Figure 24. 29
seconds,
1330_18316



Figure 25. 70
seconds,
1330_18320



Figure 26. 109
seconds,
1330_18324



Figure 27. 149
seconds,
1330_18328



Figure 28. 189
seconds,
1330_18332



Figure 29. 230
seconds,
1330_18336



Figure 30. 269
seconds,
1330_18340



Figure 31. 309
seconds,
1330_18344



Figure 32. 349
seconds,
1330_18348



Figure 33. 390
seconds,
1330_18352



Figure 34. 430
seconds,
1330_18356



Figure 35. 470
seconds,
1330_18360



Figure 36. 510
seconds,
1330_18364



Figure 37. 549
seconds,
1330_18368



Figure 38. 589
seconds,
1330_18372

Results for Test 3 (ID 1331)

The following table provides a summary of the temperature results. The “Initial” column provides the measured temperature at the beginning of the test. The maximum temperature recorded during the test is provided in the “Max” column. The remaining columns provide the calculated maximum average temperatures.

Table 7. Temperature Value Result Summary

Description	Initial (C)	Max (C)	30 second maximum average (C)	60 second maximum average (C)	300 second maximum average (C)	600 second maximum average (C)
0.5 meter	28	592	538	531	522	475
0.9 meter	28	555	474	447	410	385
1.5 meter	27	101	98	94	89	86
2.1 meter	27	45	45	44	43	41

The following chart(s) present a time-dependent representation of the instantaneous temperatures measured during the experiment.

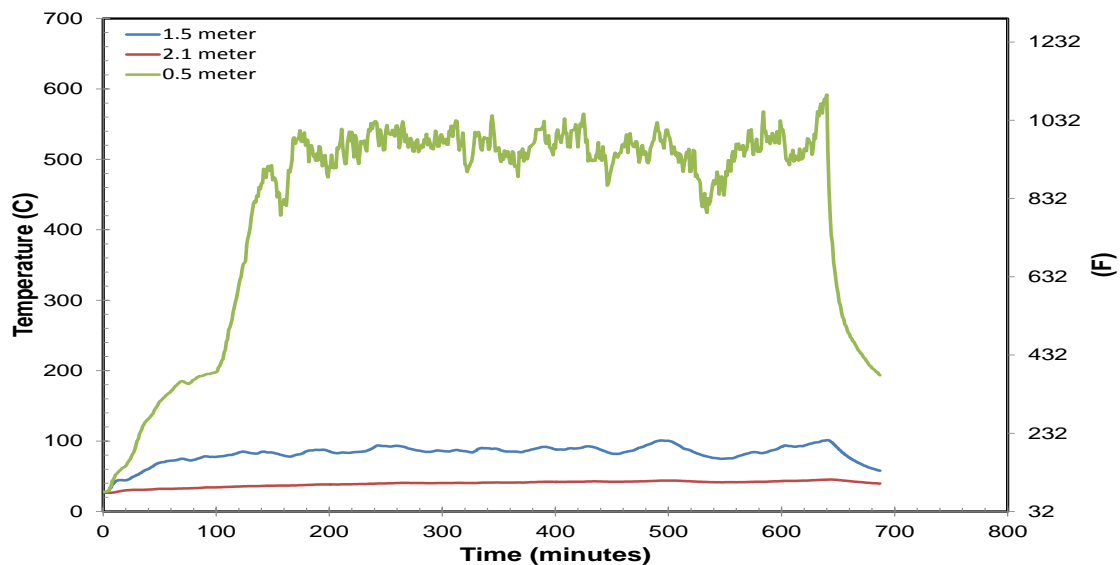


Figure 39. Temperature

The following chart shows the mass data measured during the experiment.

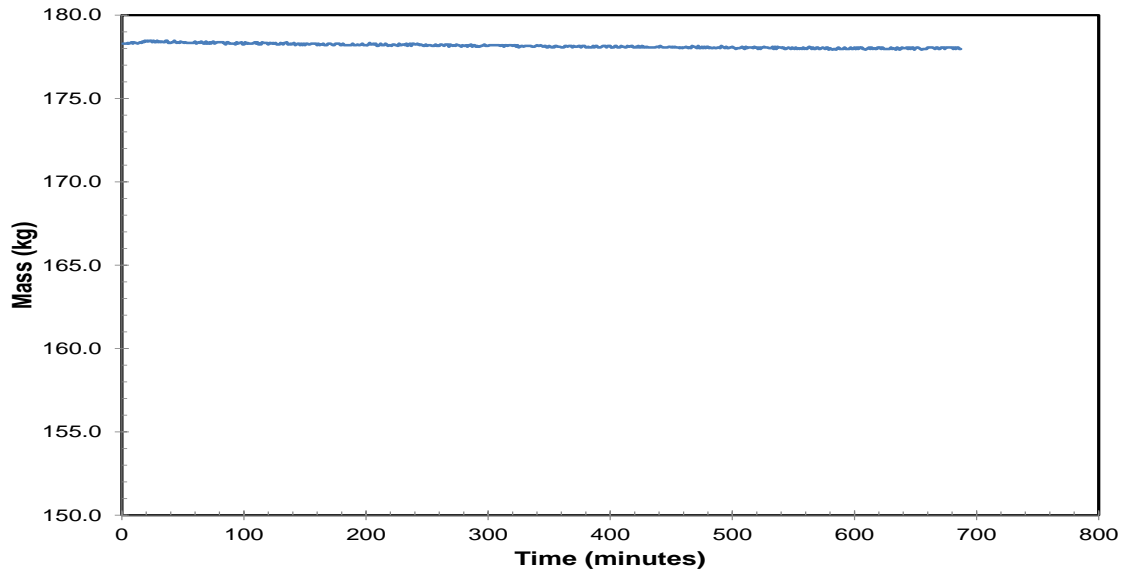


Figure 40. Mass Data

The following figures show all of the still photographs uploaded into the FireTOSS system. The caption below each figure provides the picture's filename as well as any description and elapsed test time associated with the picture.



Figure 41. Pre test
14 seconds,
1331_18400

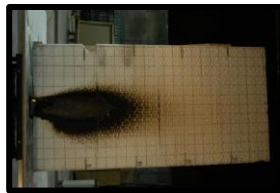


Figure 42. POST
(0:0 hr:min),
1331_18569

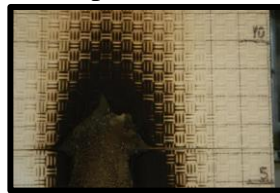


Figure 43. POST
(0:1 hr:min),
1331_18571



Figure 44. 5
seconds,
1331_18401



Figure 45. 45
seconds,
1331_18403



Figure 46. 86
seconds,
1331_18405



Figure 47. 127
seconds,
1331_18407



Figure 48. 166
seconds,
1331_18409



Figure 49. 206
seconds,
1331_18411



Figure 50. 246
seconds,
1331_18413



Figure 51. 286
seconds,
1331_18415



Figure 52. 366
seconds,
1331_18419



Figure 53. 446
seconds,
1331_18423



Figure 54. 526
seconds,
1331_18427



Figure 55. 607
seconds,
1331_18431



Figure 56. Post test
0 minutes,
1331_18572

Results Summary

The following chart shows the heat release rate of the fire during the experiment. The heat release rate is calculated based on the principle of oxygen consumption calorimetry.

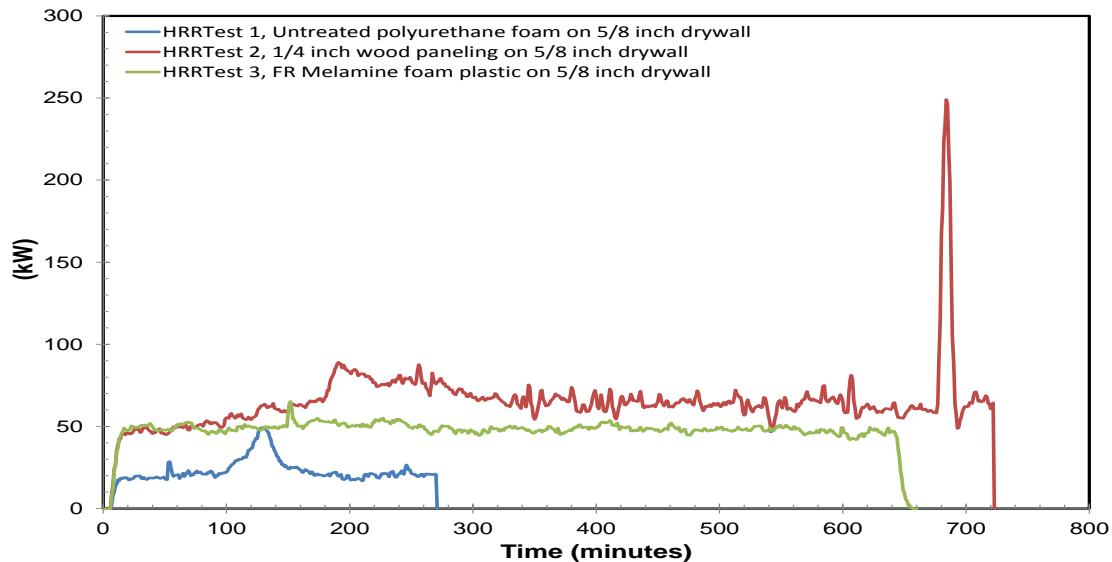


Figure 57. Heat Release Rate

References

1. The Temperature Handbook, 2nd edition, Omega Engineering, Stamford, CT, 2000.
2. Laboratory Instruction LI001 - Thermocouple, Bureau of Alcohol, Tobacco, Firearms and Explosives – Fire Research Laboratory, Beltsville, MD.
3. Laboratory Instruction – LI019 – Weighing Devices, Bureau of Alcohol, Tobacco, Firearms and Explosives – Fire Research Laboratory, Beltsville, MD.
4. Laboratory Instruction – Fire Products Collectors – LI011, Bureau of Alcohol, Tobacco, Firearms and Explosives – Fire Research Laboratory, Beltsville, MD.
5. Laboratory Instruction LI003 - Digital Cameras, Bureau of Alcohol, Tobacco, Firearms and Explosives - Fire Research Laboratory, Beltsville, MD